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LVI.—*Notes on the Salmon.* BY JOHN BLACKWALL, F.L.S.

To Mr. Shaw of Drumlanrig belongs the merit of having successfully developed the natural history of the small fish denominated Parr, whose œconomy, prior to the enunciation of his discoveries, was involved in obscurity, and was the occasion of much perplexity and hypothetical reasoning among British ichthyologists. By a series of well-conceived and skilfully conducted experiments he has not only proved that the parr is neither a hybrid nor a species *sui generis*, but has clearly established the interesting and important truth that it is the young of the salmon.

Residing in the immediate vicinity of the river Conway, for some years past my attention as a naturalist and a fly-fisher has been directed to the finny inhabitants of its waters, and to the salmon in particular. In the course of my researches several remarkable facts relative to the latter species in its earlier stages of growth have come under my observation; 1st, that young males, exhibiting all the characters of the parr, frequently have the lobes of milt fully matured, while females of the same size have the lobes of roe in so backward a state that it is necessary to employ a magnifier in order to distinguish the ova; 2nd, that these males shed their milt in the ensuing winter months; 3rd, that the males of salmon-smolts are found to have shed their milt before they descend to the sea, though the lobes of roe in the females are then of very small dimensions; and 4th, that smolts may be made to assume the barred appearance of parrs by carefully removing their silvery scales.

Perceiving that Mr. Shaw, in his "Experimental Observations on the Development and Growth of Salmon-fry," published in the fourteenth volume of the 'Transactions of the Royal Society of Edinburgh,' had noticed the phænomena enumerated above, which serve, however, in some measure, to corroborate the accuracy of his views, I put aside my notes in which they are recorded, and probably never might have recurred to them again had not an abstract of a paper "On the Growth of the Salmon," by Mr. John

Young, given in the 'Annals and Magazine of Natural History,' vol. xi. p. 157, induced me once more to turn to them, under the impression that they comprised evidence in favour of a conclusion opposed to that arrived at by the latter observer.

Concurring with Mr. Shaw as regards the history of the salmon from its rupturing the external capsule of the egg to the period when it acquires the migratory dress and descends to the sea, Mr. Young has endeavoured to determine, by observations made upon marked individuals, the growth of this species after its first arrival in the salt water.

In the months of April and May 1837, he marked a considerable number of descending smolts by making a peculiar perforation in the caudal fin by means of small nipping-irons; in the course of the ensuing months of June and July many of them were recaptured ascending the river as grilse, and weighing several pounds each, more or less, according to the difference in the length of their sojourn in the sea. Again, he marked a number of descending smolts in April and May 1842, by clipping off the adipose fin, and in June and July he caught some of them returning up the river, the adipose fin being absent. One of these specimens, marked in April and recaptured on the 25th of July, weighed seven pounds, and another, marked in May and recaptured on the 30th of July, weighed three pounds and a half.

Many small grilse, marked after they had spawned in winter and were about to redescend into the sea, in the course of the ensuing summer were recaptured as finely formed salmon, ranging from nine to fourteen pounds in weight, the difference still depending upon the length of their sojourn in the sea. A specimen marked as a grilse of four pounds in January 1842, was recaptured as a salmon of nine pounds in July.

A salmon which had spawned, weighing twelve pounds, was marked on the 4th of March, and was recaptured on its return from the sea on the 10th of July, weighing eighteen pounds.

Such are the experiments detailed in the report of Mr. Young's paper, and the inference deduced from them and others of a similar kind is that the growth of the salmon in its transition from a smolt to a grilse, from a grilse to the perfect state as to form and aspect, and also in the perfect state, is extraordinarily rapid during those portions of its existence which are passed in the sea, but Mr. Young entertains the opinion that salmon rather diminish than increase while they remain in fresh water.

Now, though it is an undoubted fact that great deterioration in the *condition* and, consequently, in the *weight* of salmon uniformly takes place while they are engaged in perpetuating their species, yet that the growth of young individuals which do not accompany their congeners to the sea is steadily progressive, ob-

servation and experiment plainly show. Salmon-fry from seven to eight inches long, having all the characters of the parr, may be taken in the Conway and its tributary streams in small numbers in the month of June, after the smolts of the season have entirely quitted those rivers, and, occasionally, I have obtained specimens of still larger dimensions, weighing four ounces. The physical cause, whatever it may be, which prevents these fish from acquiring the migratory dress and instinct of their species, evidently does not prevent them from increasing in growth and improving in condition, even the males which have shed their milt presenting every appearance of renovated health and vigour.

Mr. Yarrell, in his 'History of British Fishes,' vol. ii. p. 21, states that a large landed proprietor in Scotland, in April 1831, put a dozen or two of small salmon-fry, three or four inches long, into a newly-formed pond between three and four acres in extent. No fishing was allowed in this pond till the summer of 1833, when several of these salmon were taken, weighing from two to three pounds, perfectly well-shaped, well-coloured, and well-flavoured. As these fish must have been in their second year when put into the pond, it follows that they attained to the weight of two or three pounds in rather more than three years.

In the Supplement to the second volume of Mr. Yarrell's work other examples of the growth of young salmon in fresh water are given (pp. 5, 6), from which it appears that in one instance there was an increase in weight of eleven or twelve ounces in sixteen months, and in another instance an increase of fourteen or fifteen ounces in twenty-seven months.

I shall now proceed to inquire into the growth of the salmon during its sojourn in the sea.

Early in the month of June, salmon in high condition, ranging from three to five pounds in weight, ascend the Conway in considerable numbers if the state of the water be favourable; but that they cannot be identical with the smolts of the same year is manifest, because the inversion of established physiological principles is involved in the opposite supposition; for as great numbers of grilse weighing from half a pound to a pound come up the same river in August, full two months later than the former, there is no escaping from the unphilosophical conclusion to which such a hypothesis leads; namely, that young salmon decrease in size as they increase in age. To avoid the awkwardness of this dilemma, it is only necessary to admit the identity of the small grilse which ascend the Conway in August with the smolts of the preceding spring; and this view of the subject, which, if correct, completely subverts the theory of the all but preternatural growth of the salmon in salt water, derives support from the gradual increase of

this species in size when restricted to fresh water, and from some circumstances attending the loss of its teeth from the vomer.

Adult salmon of average dimensions are known to have one or two teeth only at the anterior extremity of the vomer, though smolts have the same part amply provided with teeth extending along a great portion of its length. In the summer of 1840 I examined numerous specimens of salmon in various stages of growth, for the purpose of ascertaining the period at which the teeth begin to disappear from the vomer and the order in which they are shed. Specimens weighing from two to five pounds, taken in the months of June and July, had from three to seven teeth on the anterior part of the vomer, the number, allowing for the difference in condition, being almost always inversely as the weight; and individuals of a larger size, captured at the same time, usually retained one or two teeth only, situated quite at its anterior extremity. Other specimens weighing from half a pound to a pound, taken in the month of August, were found to have the vomer well supplied with teeth except at its posterior part, from which some had been lost invariably. The situation which the lost teeth have occupied is distinctly marked by dark spots in small grilse, but as they increase in size these spots become more obscure and, ultimately, are obliterated.

As the teeth disappear from the vomer gradually and nearly in regular succession, those at the posterior part being shed first, it follows that the youngest fish, generally speaking, will have lost the fewest; consequently, the small grilse which ascend the Conway in August may be safely regarded as identical with the smolts which descended the same river in the preceding spring.

Having attempted to show that the growth of the salmon during its first visit to the sea is not so rapid as has been supposed, I may state that I see no reason for believing that it is accelerated in an extraordinary degree at any subsequent period of its life. The salmon which come up the Conway annually exhibit every gradation in weight from half a pound, or under, to twenty-five and thirty pounds; this would hardly be the case were the belief in their extremely rapid growth well-founded, neither would individuals of large dimensions bear so very small a numerical proportion as they are known to do to those of a medium size.

In pursuing researches of this description it is desirable that measurement should be attended to as well as weight, for salmon of the same weight precisely often differ remarkably in their dimensions according to the *condition* they are in; and the neglect of this circumstance, I am inclined to think, has contributed greatly to encumber the question with difficulties.

I feel unwilling to offer any comments upon Mr. Young's ex-

periments, not being in possession of all the particulars given by the author in connexion with them; but I may be permitted to remark, that *condition*, considered with reference to weight, must have exercised no small share of influence in the case of the grilse marked by him after they had spawned in winter, and recaptured in the ensuing summer as finely-formed salmon weighing from nine to fourteen pounds; in the instance of the specimen marked as a grilse of four pounds in January 1842, and retaken as a salmon of nine pounds in July; and also in that of the salmon weighing twelve pounds, marked on the 4th of March, after it had spawned, and recaptured on the 10th of July, weighing eighteen pounds.

For the following table of the dimensions and weight of salmon differing in condition I am indebted to my brother, Mr. Thomas Blackwall.

Length in inches.	Girth in inches.	Weight in pounds.
23 .....	13 .....	5
26 .....	12 .....	5
28 .....	— .....	5
26 .....	13 .....	7
29 .....	14 .....	7
29 .....	15 .....	8½
31 .....	15 .....	9
28 .....	18 .....	11½
33 .....	15½ .....	11½
35 .....	17¼ .....	15½
34 .....	18 .....	16
36 .....	19½ .....	18½
39 .....	18½ .....	18½
36 .....	20 .....	20
42 .....	18 .....	21
39 .....	20½ .....	23
34 .....	13 .....	—

The salmon which ascend the Conway are frequently infested externally by the *Caligus curtus* of Müller, and internally by *Entozoa*, three perfectly distinct species being sometimes found in the intestines of the same individual. These internal parasites abound in salmon newly arrived in the fresh water; but in various specimens which I have examined in March, when they had spawned and were about to return to the sea, scarcely any were to be seen. My observations, however, are too limited to warrant the deduction of any general conclusions in relation to this curious subject, which certainly merits further investigation.

P.S. I have ascertained by repeated dissections of the young of the Salmon Trout, *Salmo trutta*, that the males of that species shed their milt before they descend to the sea, but that the fe-

males do not spawn till they return from their first visit to the salt water, though some inequality in the development of the ova may frequently be perceived towards the end of April and the beginning of May in specimens measuring from six to seven inches in length which have assumed the migratory dress. Young salmon trouts weighing from half a pound to a pound are observed to ascend the Conway in considerable numbers every year in August, and adults of large dimensions are, at all times, very much scarcer than those of a medium size. From these facts I am led to infer that the salmon trout, in its œconomy and rate of growth, bears a close resemblance to the salmon.

Oakland, May 8th, 1843.

LVII.—*Short description of a Bottle-nose Whale stranded upon the coast of the co. Louth in the autumn of 1840.* Communicated to the Nat. Hist. Society of Dublin, by O. B. BELLINGHAM, M.D.\*

A SPECIMEN of *Hyperoodon Butzkopf* became entangled on the evening of Oct. 6, 1840, upon a bed of rocks, which run some distance into the sea, and are partially uncovered at low water, off Salterstown near Dunany Point, co. Louth, and next morning was found nearly dead by some fishermen, by whom it was towed to Johnstown Beach.

It was a male, and measured 23 feet 7 inches in length; the greatest circumference behind the pectoral fins 13 feet 8 inches; snout measured 2 feet 7 inches, and the tail 6 feet across.

The skin was smooth, polished, and of an olive-black colour.

Eyes small, dark, and somewhat larger than those of the ox; immediately behind each eye was an opening about 5 inches in length and 2 broad.

There were 2 small teeth in the extremity of the lower jaw, buried at least 2 inches in the gum.

No remains of food were found on examination in the stomach or intestines.

The blubber yielded upwards of 120 gallons of oil.

*Observations.*—The *Hyperoodon Butzkopf* of Lacépède, *Hyperoodon bidens* of Fleming, *Ceto-diodon Hunteri* of Jacob, *Bottle-head* of Dale, and *Bottle-nose Whale with two teeth* of Hunter, is so little known to British naturalists that the most trifling particulars respecting it possess interest. This is the third specimen of this species which within the last four years has been stranded upon the same part of the coast of the co. Louth; two of these

\* A drawing of the animal, made by Lieut. Raye, R.N., was exhibited to the meeting.